

Maze Navigation with Visual SLAM

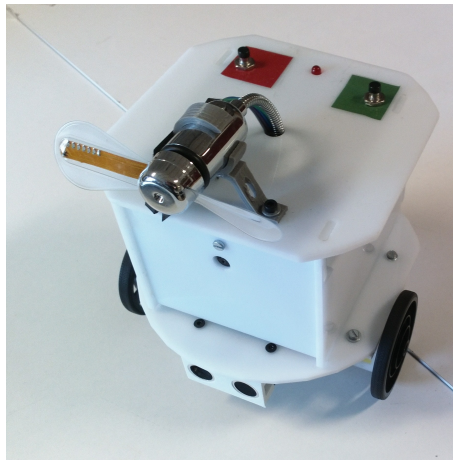
Project proposal

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1 Goals

Monocular vision is a challenging approach for obtaining depth information from a scene since one has to collect indirect cues such as several images captured from different viewpoints of the scene, use shadows, motion or shade to infer the geometry of the scene and so on. An ideal approach to understanding the geometry of a scene would be to take advantage of a 3D sensor, but for some applications, this is not possible.

In this project, a small robot based on a Raspberry Pi 4, will do Simultaneous Localization and Mapping (SLAM) in a maze, using only a single 2D camera. This requires that the robot uses some smart techniques to detect depth in the scene, particularly because the maze consists of several low texture white walls.



The work will be done by adapting some already existing code in ROS [2] to our particular context.

The project will use ORB-SLAM3, a monocular SLAM approach [1].

2 Work plan

The project has the following tasks:

T1 Introduction to robotic navigation and ROS (3 weeks).

T2 Study the requirements for the application and integrate already existing code (4 weeks).

T3 Implement new code to solve some of the remaining necessary requirements and integrate everything in the prototype (6 weeks).

T4 Write the project's report (2 weeks).

3 Expected Results

- A method that can make the robot navigate a maze using a single camera
- Source code and documentation of all code developed
- Project report

4 References

- [1] Carlos Campos, Richard Elvira, Juan J. Gómez Rodríguez, José M. M. Montiel, and Juan D. Tardós. Orb-slam3: An accurate open-source library for visual, visual-inertial, and multimap slam. *IEEE Transactions on Robotics*, 37(6):1874–1890, 2021.
- [2] Morgan Quigley, Ken Conley, Brian Gerkey, Josh Faust, Tully B. Foote, Jeremy Leibs, Rob Wheeler, and Andrew Y. Ng. ROS: an open-source robot operating system. In *ICRA Workshop on Open Source Software*, 2009.